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Ordered Packing of Surfactant-Encapsulated Giant Polyoxomolybdate Nanospheres on Si(111) Surface

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Introduction: The packing structure of a kind of newly discovered polyoxomolybdate nanoclusters on Si (111) surface was studied by X-ray surface scattering. This work provides first insight study on the structure of this new material on surfaces, stabilized by long-chain surfactants.

Methods and Materials: X-ray surface scattering spectrometer has been used. The giant polyoxomolybdate nanoclusters were prepared by a method reported before. The DODA (dioctadecyldimethylammonium bromide) surfactant was used to take the giant nanospheres from aqueous solution into chloroform phase. Single nanoclusters encapsulated by surfactants were obtained and deposited onto Si(111) surface.

Results: Chloroform molecules were evaporated quickly. The remaining surfactants and polyoxomolybdate giant nanospheres were phase separated. The bare giant nanospheres were found to pack into a closed face-centered cubic (fcc) packing on Si surface. The scattering curve below represents a measurement along the vertical Z – direction. Several scattering peaks can be identified, corresponding to the indexes of (111), (200), (222), (333), and so on, indicating a typical fcc structure, with the dimension of the unit cell of 5.0 nm. We already know that under normal conditions, these giant nanoclusters choose primitive cubic packing (pc). Therefore, it is very interesting to see that the same giant polyoxomolybdate nanoclusters choose different packing structure on Si surface.

Conclusions: The effect of Si surface on the packing of the polyoxomolybdate giant nanospheres has been studied by surface scattering technique. Due to the existence of the surfactant molecules, the nanoclusters chose to pack into fcc structure (closed-packing) on Si surface instead of pc structure. The study of the effects of different surfaces and their further applications is on the way.

References: T. Liu, Q. Wan, Y. Xie, C. Burger, L.-Z. Liu, B. Chu, J. Am. Chem. Soc. 2001, web-released on Oct. 11th, in press.

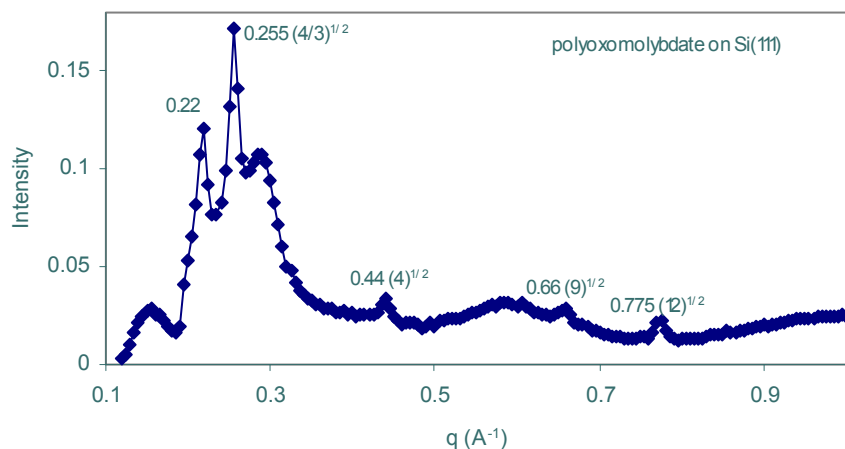


Figure 1. Surface X-ray scattering study of the packing of DODA-encapsulated polyoxomolybdate giant nanoclusters on Si (111) surface along Z-direction.